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COST OF MILK PRODUCTION ON FORTY-EIGHT WISCONSIN FARMS.[1]

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NOTE.—The writer wishes to express his appreciation of the patience and courtesy of the cooperating farmers in making reports, and to thank a number of other men and women who have helped in the preparation of the bulletin.

The purpose of this study was to observe the management of a number of herds kept under ordinary farm conditions and to measure the more important factors of cost, with a view to determining the nature and degree of changes in management which may be expected to result in a more favorable relation between income and expense as prices of materials and of products change. Information was gathered through regular reports submitted by the farmers, supplemented by personal observations. The determination of an average cost figure was urgently solicited by farmers, with a view to influencing prices paid by consumers and factories, but for reasons apparent to all who are familiar with cost data, this figure is of only minor significance.

Milk production is only a part of the farm business on most Wisconsin dairy farms. Besides milk production, there are the herd itself, other classes of productive livestock, the corn, small grains, and hay grown to feed the livestock, and a variety of special crops grown for sale. Each of these other enterprises contributes more or less to the farm income, and entails its share of the farm expense. These shares are variable and not always well defined. Moreover, there are wide differences in the amount and value of land, buildings, equipment, and labor devoted to the several farm enterprises.

[1] The data for this bulletin were gathered by the writer under a cooperative arrangement between the Bureau of Agricultural Economics, United States Department of Agriculture, and the University of Wisconsin. The Wisconsin Division of Markets also assisted in the field work.

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It would be desirable if these various enterprises could be made to stand on their own merits, and to some extent they do, but the decision with respect to the management of any one of them does not depend solely on the fact of a figured profit or loss in any season or period of years, but rather on how it fits in the general farm operations. An enterprise will be continued as long as it pays better than any other which could be substituted for it, and as long as it contributes to the net income of the farm, either directly or indirectly.

As indicated above, the typical dairy farm has several activities more or less closely related to each other, a fact which tends to obscure the relations between the income and expenses for each and affects the decisions which will be made from time to time as costs and prices change.

The chief element in the cost of producing milk is feed, with labor next, the two together constituting two-thirds or more of the total cost. The remainder consists of a number of smaller incidental charges. In order to simplify the discussion as much as possible these are taken up separately. With the same purpose in view, milk production is considered primarily as an independent enterprise, then in its relations to the whole farm business. That the figures may be most generally usable, they are given as quantities to which anyone may apply prices or cost rates for any given time or locality. On the average, these basic factors of cost do not change so much or so frequently as do prices, although they show a wide range, suggesting the possibility of important changes in financial results to be brought about by changes in management.

The figures presented were obtained through the cooperation of 48 farmers during the calendar year 1920. These farms were divided into five groups, according to similarity in the more important factors of location, markets, feeds, herd management, and the like. Group A is made up of 12 farms in the eastern part of Sheboygan County; group B includes 8 farms in the eastern part of Columbia County; group C includes 11 farms west and south of Milwaukee in the Milwaukee milk district; group D is made up of 8 farms also in the Milwaukee milk district, but lying in a compact group to the north, most of them in Ozaukee County; group E includes, besides 7 farms in the southeast corner of Marathon County, 2 other farms of similar characteristics, but in other counties. (See Table 1.) The farms range in size from 17 acres to 240 acres, the size of herds from 3 cows and 1 heifer to 28.7 cows and accompanying stock cattle; in production from 13,000 pounds average per cow, including dry time and discards, down to 2,830 pounds per cow for the year. Some of the herds were purebred, but most of them were grade herds, with or without some pure-bred animals.

TABLE 1.—*General characteristics of the farms studied.*

	Group A (Sheboygan County).	Group B (Columbia County).	Group C (Milwaukee County).	Group D (Ozaukee County).	Group E (Marathon County.)	All farms.[1]
Number of records	12	8	11	8	9	48
Average area.....acres	75	145	107	59	106	97
Crop area.....do	55	98	74	49	45	64
Pasture area.....do	14	43	30	9	49	28
Horses, per farm....number	3	4	4	3	3	3
Land value, per acre	$200	$120	$150	$150	$70	$137
Land value, per farm	$15,000	$17,500	$16,000	$8,800	$7,400	$13,300
Buildings, value per farm	$4,600	$7,800	$8,000	$4,500	$3,100	$5,600
Machinery, value per farm [2]	(9) $1,490	(6) $2,250	(5) $1,700	(8) $1,275	(9) $1,470	(37) $1,590
Number of cows, per farm	13.1	18.5	14.2	9.6	10.2	13.1
Milk produced, per farm, pounds	128,606	128,926	95,215	60,123	56,655	96,103
Average milk produced per cow, pounds	9,820	6,940	6,700	6,290	5,570	7,320
Winter production..per cent	46.5	59.4	58.2	49.2	46.2	51.9
Summer production....do	53.5	40.6	41.8	50.8	53.8	48.1
VARIATIONS OBSERVED IN THE FACTORS SHOWN.						
In size of farm:						
Largest.....acres	150	210	171	79	240	240
Smallest.....do	17	72	58	26	32	17
In number of cows:						
Largest herd	18.4	28.7	28.2	12.6	23.8	28.7
Smallest herd	7.4	7.5	5.2	4.2	3.0	3.0
In average production, pounds per cow:						
Highest herd	13,000	8,370	8,050	9,350	6,320	13,000
Lowest herd	8,050	4,950	4,170	5,220	2,830	2,830

[1] The rates in this column in all tables are weighted averages figured from totals.
[2] Figures in parentheses show the number of farms reporting.

The quantities of feed and labor used, the number of cows in the herd, and the amount of milk produced were reported each month, together with price of feeds and of milk. A financial record was also kept, from which the data for figuring the other costs were obtained. The observations were made by working farmers for their own herds. Although they did not go into the more minute details, the farmers were conscientious in their observations of the main elements. For this reason it would seem possible for any farmer with little difficulty to check for his own farm any of the facts and conclusions here presented.

FEED REQUIREMENTS AND CONSUMPTION.

Naturally the kinds and amounts of feed supplied to cows for milk production vary greatly. Not only are the kinds and qualities of feeds on different farms numerous, but the number is multiplied by all the kinds and grades that may be purchased.

Henry and Morrison, in "Feeds and Feeding," tabulate analyses of nearly 350 feeding stuffs used in the United States. Twenty-six different concentrates, nine kinds of dry roughage, and eight kinds of succulent roughage, besides pasture, were reported as fed to a group of cows in association work in Wisconsin. Of course, these different feeds have different values for milk production—values which are more or less accurately reflected in the usual schedules of prices for the various components, materials, and mixtures.

Obviously all these different materials must be reduced to fairly definite relations to some standard if feeding animals is to be anything short of pure guesswork. Profitable feeding is a fine art, but an art developed on a basis of countless experiments to determine, by chemical analyses and by physical measurements, the relative values of different feeds for production and the feed requirements of cows of different capacities. The standards thus established serve as a means of reducing the different feeding practices to a common basis for comparison, and as a rough guide to the prices which may be offered or demanded for feeds of various kinds.

Armsby's feeding standards, as given in Henry and Morrison's "Feeds and Feeding," 1917 edition, have been used in the calculations of feed values and feed requirements for this study, the principal unit of measurement being the therm of net energy. Digestible protein must not be overlooked, however, in compounding rations or in comparing the values of concentrates, especially the cereal and oil-mill by-products which are used to balance rations.

The quantities of grain, hay, silage, and fodder fed to herds in the five groups are shown in Table 2. The term "grain" includes, besides the home-grown corn, oats, and barley, the various purchased mill feeds, brewers' grains reduced to a dry basis, and beans. The hay fed was mostly clover, with some alfalfa. Silage includes, in addition to corn silage, pea silage, with small amounts of soiling crops on a dry-matter basis. "Fodder" was mostly cornstalks, including little or no grain. Besides the feeds thus supplied, the cows had pasture in varying amounts and of varying qualities. The term "pasture" covers all the feed the cows gather for themselves during the summer, from wild or rough land unsuitable for crop production, from meadows or fields definitely set aside for the purpose, and from the aftermath of the other fields. Thus, pasture is an exceedingly variable quantity, both in the amount of feed provided and in the number of cows it will support and the time it will provide feed. It is unfortunate that pasture can not be more clearly defined and directly measured, as it plays a very important part in the management of dairy herds.

In order to approximate the amount of feed supplied by pasture and to explain the relations between feed consumption and milk production, the feeding standard and analysis of feeds mentioned above were used in calculating the feed requirements of the cows and for comparing the amounts of feed supplied in the several areas. The pasture season may begin in April and may continue into December. For present purposes the year was divided into two periods of six months—the winter season November 1 to May 1, and the "summer," or pasture season, from May 1 to November 1. Many farmers do not turn the cows out to pasture until the latter part of May and are obliged to resume feeding by the middle of July. The practice varies, of course, with the amount of feed supplied by pasture and the number of animals to be fed. The price of feeds and of milk affect the use of pasture; in 1920, with feed high in price and falling milk prices, many farmers did not resume feeding as early as they would under normal conditions.

The estimated annual feed requirements of the cows included in the study, due allowance being made for differences in size of the

cows, the quantity of the milk produced and its quality, were computed according to the Armsby feeding standard (see Table 2). The net energy values of the average quantities used of the different feeds were then computed. The feed contribution of pasture was computed as the difference between the net energy required and the net energy supplied by the feeds supplementing pasture during the 6 months from May 1 to November 1. This calculation assumes that the cows maintained approximately the same body weight during the year, which, however, is not strictly true. On this basis, pasture supplied nearly one-fourth of the estimated feed requirements of the cows and somewhat less than that proportion of the total net energy supplied during the year.

TABLE 2.—*Feed consumption per cow and per 100 pounds of milk produced on 48 Wisconsin farms, 1920, together with the computed net energy values of this feed.*[1]

	Group A.	Group B.	Group C.	Group D.	Group E.	All farms.
Number of farms	12	8	11	8	9	48
Average production per cow, pounds	9,820	6,940	6,700	6,290	5,570	7,320
ANNUAL FEED CONSUMPTION, PER COW (IN ADDITION TO PASTURE).						
Grain, pounds	2,987	7,914	1,854	1,484	1,056	1,990
Hay, pounds	2,045	2,581	2,743	2,358	2,372	2,430
Silage, etc., pounds	8,496	7,993	7,640	9,140	3,948	7,591
Fodder, pounds	852	124	448	1,527	393	595
NET ENERGY VALUES OF FEED SUPPLIED PER COW.						
Estimated requirement (year total), therms	4,850	4,085	4,304	3,772	3,949	4,490
Reported fed, therms	4,576	3,618	3,870	3,849	2,375	3,750
Pasture supplied, therms	859	1,248	961	914	1,574	1,053
Total provided, therms	5,435	4,866	4,831	4,763	3,949	4,803
Per cent of total required supplied by pasture	17.7	30.6	22.3	24.2	40.0	23.5
FEED SUPPLIED (IN ADDITION TO PASTURE) PER 100 POUNDS MILK.						
Grain, pounds	30.4	27.6	27.7	23.6	19.0	27.2
Hay, pounds	20.8	37.2	40.9	37.5	42.6	33.2
Silage, etc., pounds	86.5	110.1	119.3	145.4	71.4	103.7
Fodder, pounds	8.7	1.8	6.7	24.3	7.0	8.1
VARIATIONS OBSERVED IN RATE OF FEEDING GRAIN.						
In quantity of grain fed per cow:						
Largest, pounds	5,454	2,614	3,053	3,146	1,807	5,454
Smallest, pounds	1,265	1,144	735	763	209	209
In grain fed per 100 pounds milk:						
Highest, pounds	43.5	39.6	45.2	34.3	28.5	45.2
Lowest, pounds	16.7	21.1	12.0	14.3	5.9	5.9

[1] The net energy values and standard requirements used in the computations for this and other tables in this bulletin are those published in "Feeds and Feeding," edition previously referred to. In his book, "Nutrition of farm animals" (1917), Dr. H. P. Armsby discusses the whole problem of feeding cows in minute detail, making a revision of the standard net energy requirements for milk production of approximately 10 per cent less than the figure used in these computations, based on the earlier tables. As these older tables are probably much more generally available to farm readers through "Feeds and Feeding," and Professor Eckles's book, "Dairy Cattle and Milk Production," and his research bulletins published by the Missouri Agricultural Experiment Station, the computations have been made on that basis rather than according to the modified standard.

It is evident that high-producing cows need more feed than low-producing cows. It is conceivable that production may be limited by lack of sufficient feeds of the proper kind. How far it is possible to increase production by supplying more feed is a question which can be answered only by trial, but it was acknowledged by some of the farmers reporting that their cows gave, in 1920, less milk than usual because of restricted grain feeding owing to relative prices of feeds and milk. The higher yields must usually be obtained by increased use of concentrates. Cows use digestible protein and net energy for two purposes; first, to maintain their bodies, and, second, for producing milk or flesh. The protein and net energy devoted to the first purpose are called the maintenance requirements and the feed supplying them the "maintenance ration." Whatever digestible protein and net energy there may be in the ration above the maintenance requirements are devoted to production. Milk production

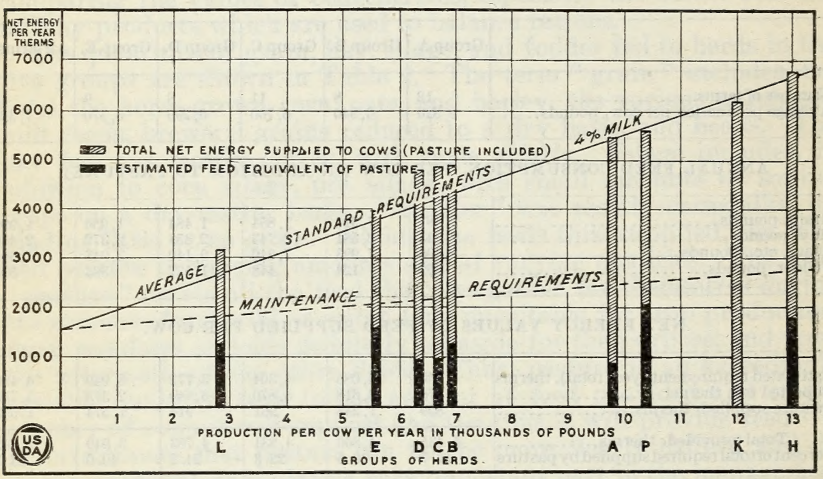

FIG. 1.—Computations of the net energy supplied to cows as reported by farmers compared with standard requirements show a very intimate relation between quantity of feed and quantity of milk produced, a relation which liberal feeders turn to their advantage.

may be limited by the amount of digestible protein supplied, and as the annual yield increases more attention must be given to this factor (as feeders recognize by adding more grain), especially the high-protein concentrates for their best cows. Total amount of feed, even of a well-balanced ration, may be a limiting factor in milk production. The amount of milk produced is the basis for feeding cows individually instead of giving the same amount to each. Some feeders still persist in the latter practice.

The relation between the maintenance requirements, total requirements, and milk production at rates up to 13,000 pounds per year is indicated in Figure 1. The upright bars show the production per cow in nine cases; H represents the highest herd; L, the lowest herd; A, B, C, D, and E, the averages of the groups into which the farms are divided; K, a single cow reported by Professor Eckles; and P, 120 cows taken from the Register of Production (Circ. 129 of the Wisconsin Agricultural Experiment Station). The full length of

the bars shows the net energy values of the feed supplied in the respective cases, including the allowance for pasture as above noted. The solid part of the bars shows the net energy attributed to pasture.

The higher-producing cows are unusally larger than the lower-producing cows, and require more for maintenance, but the difference is not very great; in fact, some high-producing cows may be smaller than their lower-producing sisters. The total net energy requirements increase more rapidly after maintenance is provided; the requirements for production increase uniformly with increase in milk yield of the same quality; milk rich in butter fat, however, requires a higher rate per pound of milk than low test milk. (The net energy requirements for milk production is given by Armsby as 0.3 therm for each pound of 4 per cent milk. The revised standard for 4 per cent milk is given as 0.265 therm per pound of milk, which is 10 per cent less than the figure used in these computations as noted above. Similar reductions are given for milk of other butter fat tests.)

The comparative economy of high-producing cows in a dairy enterprise is widely recognized. In this regard, tests conducted under comparable conditions, as in cow-testing association work, are conclusive. Considering the whole farm business, however, under different conditions, the case is not so clear, complicated as it is by varying prices and amount of feeds. The feeds consumed per 100 pounds of milk are shown in Table 1, together with the number of therms of net energy reported fed, including the allowance for pasture. The unit requirements shown in the table can hardly be used for single months or shorter periods, as they vary widely throughout the year according to practice and production, each of the items ranging from nothing up to a high figure per 100 pounds. Their unit requirements will nevertheless apply reasonbly well to different years because feeding habits do not change rapidly.

While the higher-producing cows consume the larger quantities of feed, particularly of grain, the difference is not so great when reduced to a unit basis, as is indicated in the case of grain in Figure 2, showing the average annual production of each of the herds and the number of pounds of grain fed per 100 pounds of milk produced.

The problem of feeds is presented in this detail to develop the method of calculating the feed equivalent of pasture, and to reiterate the advantage of adequate feeding of cows. Within the limits observed on these farms and up to the point where cows begin to show marked evidence of putting on flesh, production seems to increase with the quantities of feed supplied, financially as well as physiologically.

The prices used in figuring the cost of feed in 1920 were as follows:

Grain, $60 per ton; hay, $25; silage, $10; fodder, $15, and pasture $15 per cow for the season, with local variations.[2] At these rates the feed cost of milk was $2.02 per 100 pounds. These were the prices most commonly named, and they represent market values at the farm rather than actual cost. The actual cost of growing the crop is difficult to work out from data ordinarily available. Moreover, the

[2] For the Marathon group (Group E) the price of grain was $75 a ton and of pasture $9 a head for the season.

farmer feels that he ought to get through his cows as much as he would receive by selling his grain and hay.

One trouble with using market prices for feeds is that the home-grown feeds are not put to the test of sale agreement between interested parties as to grade. Much of the feed used for livestock is not marketable, or if marketable would be docked in price. Hay, however, has a relatively high market price because so much of it is fed out at home that the surplus is seldom more than enough to meet the demand of deficit areas. Then, too, the memory of high prices received persists, and it is common to assume that all the available supply might have been sold at those prices if it had not been fed, which of course is contrary to the experience of the most optimistic speculators. Then there is the expense of getting the feeds to market and the important consideration of maintaining fertility of the land through use of farm manure.

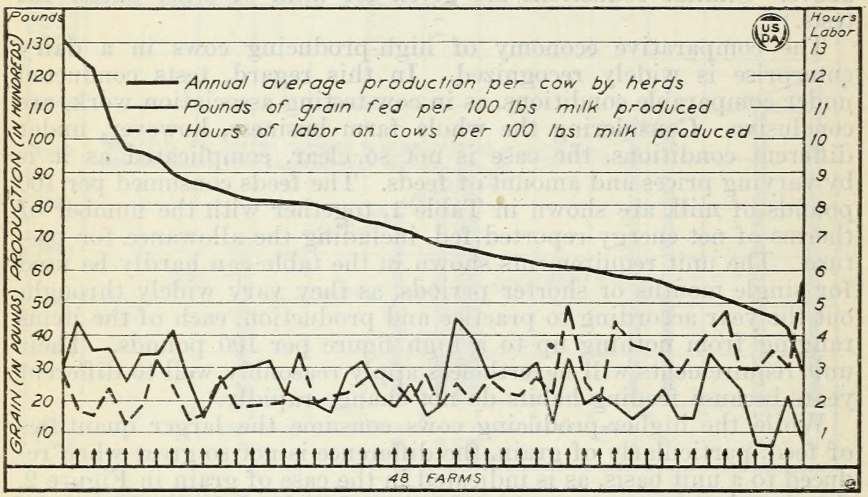

FIG. 2.—The higher producing cows usually get a higher proportion of concentrates in their rations than the others. The high producers are economical of labor.

Some farmers had to pay, in 1920, as high as $100 a ton for a part of their feed (in bag lots). Most of the purchased grain fed during the year was bought at prices above $60 per ton—even bran nearly touching that figure. Oats and corn would have sold for more than this for a considerable time. Although the price dropped sharply in the fall, and farmers perhaps did not get $60 per ton for their feed through the cows, it is felt that $60 is a reasonable figure to use.

Hay is figured at $25 per ton, though some hay was purchased at $30 and quotations for alfalfa went even higher. It takes a high price to make it worth while for a farmer to sell hay, especially if his farm is heavily stocked. Hay at $25 in the barn will ordinarily show a profit over cost of growing. This is approximately its conversion value compared with grain at $60 per ton.

Silage at $10 per ton is high or low according to the yield per acre. At ordinary yields, common practice and going rates for labor, corn silage cost very close to $10 per ton for the 1919 crop, most

of which was fed in 1920. The 1920 crop also was made with high-priced labor. The pea silage bought cost about $2.50 per ton, plus the labor of getting it, which, while considerable in amount, was done at odd times. The beets and the pea-vine silage fed were placed on the same basis as corn silage. Silage does not have a market value, but is assigned its value in various ways, sometimes from the price of corn, sometimes from cost of putting it up, sometimes from values of some feed which it will replace. Occasionally silage is sold at auction, but the price paid at a sale is not a very good indication of value, depending as it does on the necessities of the bidders and the cost of moving it to the place where it will be fed. Corn fodder has about twice as much dry matter per ton as silage, and nearly twice as much net energy, but is subject to somewhat greater waste, and is not highly rated where hay is abundant. If it may be contended that the prices used are too high for home-grown feed, it can hardly be denied that if all the feed needed had been purchased the total feed cost would have exceeded the amount figured. At any rate, such other prices as may seem fitting may be applied by anyone who wishes to take exception to those used.

In 25 cases where the cash paid out for feed for cattle was accounted for separately, the range was from $45 to $2,200, with an average somewhat more than $600 per farm. The average total feed cost for cows per farm at the rates given above is as follows: Group A, $2,345; Group B, $2,548; Group C, $2,131; Group D, $1,397; Group E, $1,001; all farms, $1,937. This compares with a general average of $2,569 per farm as the value of the milk produced. The average offset for manure is $278 per farm, ranging from $158 in Group E to $414 in Group B. (See manure credit below.) In special cases the manure may be worth more than this—when the quantity of concentrates fed is large, the need of the land great, and the management of the manure such as to avoid ordinary losses of plant-food value.

MANURE CREDIT.

The value of the manure produced on a dairy farm is considerable. It is generally shown as a credit or offset to cost. It is not a cash item, as it might seem to be at first glance from its usual position in the cost statements. It is closely associated with the prices or cost of feeds. If the farmer buys feed, he brings fertility to his farm; if he feeds his own crops he retains part of the fertility on his farm and can better afford to figure his feed as costing less than market price (less cost of marketing) than he can to part with his crops. The price a farmer gets for any feed he sells includes some payment for the plant food contained in the feed sold. Similarly, the price he pays for feed bought includes some payment for the fertility thus secured. The value placed on this is variable, and is somewhat obscured by the primary considerations leading to sale, or by the more direct use as feed in the case of purchases. While the fact is widely recognized, consciously or unconsciously, that some allowance for the plant food saved to the farm or brought to it properly may be made, there is more or less disagreement as to the amount of the allowance which should be made. This difference arises from different needs of different farms and alternative sources of plant food.

The amount of manure recovered and drawn to the fields is about 1 ton a month for each cow. The feeding season is about 7 months; the other 5 months the cows are outdoors most of the time. The estimated value of manure on Wisconsin farms in 1920 is $2.25 a ton for that produced during the feeding season and about half that price for the manure left on the fields and pastures, together amounting to $21.25 for the year for each cow.[3] At this rate the credit to milk production on account of manure is 29 cents per 100 pounds for the farms studied.

LABOR APPLIED TO MILK PRODUCTION.

The man labor spent on cows and milk per cow averaged 171 hours per cow for the year, or 28 minutes a day. This covers milking, feeding, caring for the barns, utensils, and the like. It does not include hauling manure away from the barn, delivering the milk, or care of the young stock. One farmer with a large herd spent 368 hours per cow of direct labor on cows, while the least work reported was 116 hours per cow. Five farms spent as little as 20 minutes a day per cow on care of cows, and only four farms spent more than 45 minutes per cow. Five farmers used milking machines part of the year and by use of them were able to reduce the labor to a low point, but several other farmers not equipped with machines spent very little more time on their cows than those using machines. The total labor on the dairy herd averaged 2,706 hours per farm for the year, of which 2,251 hours was for cows. The labor requirements by groups of farms is shown in Table 3.

TABLE 3.—*Labor requirements. Hours of labor per farm, per cow and per 100 pounds of milk produced, together with variations observed, on 48 Wisconsin dairy farms in 1920.*

	Group A.	Group B.	Group C.	Group D.	Group E.	All farms.
Number of farms	12	8	11	8	9	48
Average production, per cow, pounds	2,820	6,940	6,700	6,290	3,370	7,320
LABOR REQUIREMENTS (HOURS).						
Total per farm, cattle	2,808	3,305	2,838	2,433	2,112	2,706
Cow work only, per farm	2,328	2,721	2,377	2,094	1,714	2,251
Cow work per cow	178	146	167	219	169	171
Cow work per hundredweight of milk	1.81	2.11	2.50	3.48	3.03	2.34
VARIATIONS OBSERVED.						
In labor per cow per year:						
Highest farm, hours	368	221	276	304	215	368
Lowest farm, hours	116	118	116	146	141	116
In labor per hundredweight of milk:						
Highest farm, hours	2.84	2.95	4.73	4.96	5.85	5.85
Lowest farm, hours	1.23	1.75	1.90	2.57	2.24	1.23

Of the total labor applied to the dairy herd, 85 per cent was spent on the cows, 5 per cent on delivering milk to factory or shipping point, and 10 per cent on caring for the young stock. Half the

[3] A. R. Whitson, head of the department of soils, University of Wisconsin, is the authority for the price here used and the allowance of half this value during pasture season.

farmers hired their milk hauled; most of those selling in Milwaukee paid for hauling. Some of the labor of milk production was performed by women and children, but such labor was converted to the equivalent of man labor.

There is considerable variation in the amount of work accomplished in an hour on the different farms. Pressure of other work has much to do with this factor. On the whole, the amount of work required is proportional to the number of cows in the herd, small herds receiving very little more time per cow than the large herds. The higher-producing herds, with one exception, where official testing was done, required no more time than the lower-producing herds. The man labor required to produce 100 pounds of milk was materially less, in most cases, for the higher-producing herds than for the lower-producing herds. The lowest requirement reported was 1.23 hours, the highest 5.85 hours. (See the broken line in Fig. 2.)

The amount of time spent on cows is affected by a number of things, the more important among them being the convenience of the stable, location of feed storage, character of equipment, personal characteristics of the owner, and distribution of production. The amount of time devoted to cows on a given farm does not increase materially with increased yield. Milking takes a little longer where yield is high, as there is more feed to handle and a few more cans to wash, but doubling production does not by any means double the work required. Any tendency to increase labor requirements of the higher-producing cows is offset by the effect of yield on the rate per 100 pounds. (See Fig. 2.)

Most of the labor on cows on these farms was performed by the farmer or his family, only 14 of the 48 employing hired men regularly. Fifteen herds were handled by partnerships, or by fathers and sons. Under these conditions it is difficult to determine an average rate of wages for the purpose of figuring the labor cost of milk. Farm wages were high in 1920; many paid $75 a month and board to hired men, a cost of about $100 per month. The monthly duty of a hired man varies considerably, but runs between 250 hours (40 cents an hour) and 300 hours (33⅓ cents an hour). In view of wages paid other workers, 40 cents an hour would appear to be a reasonable figure to use in calculating the cost of milk. On this basis the labor cost of milk in 1920 was 94 cents per 100 pounds (2.34×40). Only 48 per cent of these 48 farmers, 54 per cent of the cows, and 56 per cent of the milk would come within this figure. Hauling milk to the factory or receiving station is not included, and a hauling charge ranging from 10 to 25 cents per 100 pounds, according to amount sold and distance hauled, must also be met.

If feed is figured at market prices at the farm and the costs other than labor are considered as fixed in the computation, we find, as will be seen later, that the balance left for labor was not, on the average, large enough to pay 40 cents an hour. But, even if it had been, half the farmers spent more than the average amount of time on their milk production, and therefore accepted less than the average rate (40 cents an hour) for their labor: while those who, by doing their work more quickly or because of the high production of their cows, required less than the average time per 100 pounds, got more than the average rate. Similarly, if labor and other costs are figured at

a uniform rate, some farmers find that they got full market price for their feed, while others fell far short of it.

OTHER COSTS—INCIDENTALS, OVERHEAD.

Feed and labor make up by far the largest part of the cost of producing milk, but in addition to these major costs there are other items which must be considered in figuring total costs, such as cow cost, bull service, buildings, equipment, bedding, and general expenses (items of irregular amount and occurrence, such as insurance, veterinary expense, cow testing, and organization dues).

While it is true that these overhead expenses are higher for purebred herds than for grade herds, and for high-producing herds than for low-producing herds, they do not vary regularly with production, nor do they bear any close and necessary relation to feed and labor costs on any given farm or group of farms. The Pearson formula [4] assigns 25 per cent of the total cost to these items. A study of costs in New Hampshire in 1911 showed them to form about 10 per cent. In western Washington in 1917–1920 they were found to be 20 per cent. In northwestern Indiana they were nearly 23 per cent. In these latter studies the overhead costs were largely offset by the credits. At what figures these costs will settle in any period under observation is determined by the prices and valuations of the sundry items involved, and having been once estabilshed they maintain the given relations only if prices rise and fall together and in the same proportions. It is possible by modifying operations to reduce the proportion of overhead expense to total costs, and particularly to reduce this item in the cost of 100 pounds of milk by increasing production.

COW COST.

Cow cost is based on the fact of depreciation, whether caused by death (which entails practically the total loss of the value of the animal), by culling, or by price changes. It also includes an allowance for interest on the investment in cows, which, however, is not a loss. Cow cost is a very variable figure at best.

On these farms, 775 different cows were used to maintain an average for the year of 630.25 cows. There were 621 cows on these 48 farms January 1, 1920, appraised at $165 each; 24 cows were purchased at an average of $195; 130 heifers freshened for the first time during the year, valued at $125 each; 112 cows were sold for $150 each; 13 died and were practically a total loss; and there were left on the farms at the end of the year 650 cows, valued at $130 each. This gives a depreciation of 18 per cent for the year, or $35.20 per head for the average number kept, or 48 cents per 100 pounds of milk. This depreciation was unusually large, owing to the high price of cows in the fall of 1919, which established the value at the beginning of the year, while at the end of the year appraisal was unduly low because of discouragement over milk prices, resulting in

[4] In the course of the controversy over prices for fluid milk in the Chicago milk district in 1917 Prof. F. A. Pearson, then of the University of Illinois, brought out a statement of the unit requirements for producing milk to be used in computing a fair price to producers for fluid milk under changing costs of labor and feeds. See Bulletin 216, University of Illinois.

no demand for surplus stock, everybody wishing to cut down herds, with no purchasers in sight. The changes in values and in number of cattle are shown for each of the groups of farms in Table 4.

TABLE 4.—*Changes in values and numbers of cattle on 48 Wisconsin dairy farms during 1920.*

	Group A.	Group B.	Group C.	Group D.	Group E.	All farms.
Number of farms	12	8	11	8	9	48
Average production per cow (pounds)	9,820	6,940	6,700	6,290	5,570	7,320
AVERAGE VALUE OF CATTLE, 1920.						
Cows, Jan. 1.....each	$192	$187	$170	$95	$123	$165
Cows, Dec. 31.....do	190	115	125	65	120	130
Cows purchased.....do	193	108	159	87	263	195
Cows sold.....do	175	165	150	69	140	150
Other cattle, Jan. 1.....do	130	106	126	45	85	104
Other cattle, Dec. 31.....do	157	97	92	37	93	100
Other cattle purchased.....do	286	66	89	43	277	208
Other cattle sold.....do	46	32	39	18	47	38
Increase in value of other cattle per farm	534	794	[1] 604	181	323	[2] 493
NUMBERS OF ANIMALS (GROUP TOTALS), 1920.						
Cows, Jan. 1	164	143	156	75	83	621
Cows, Dec. 31	154	150	168	79	99	650
Cows bought	7	2	3	3	9	24
Cows sold	37	25	16	13	21	112
Heifers brought in	22	34	29	15	30	130
Cows died	2	4	4	1	2	13
Different cows	193	179	188	93	122	775
Other cattle, Jan. 1	69	116	98	47	70	400
Other cattle, Dec. 31	86	116	122	43	65	432
Purchased	25	5	10	5	10	55
Born	162	136	148	77	100	623
Sold	134	94	113	60	59	460

[1] Data available for only 10 farms.

[2] Basis is 47 farms.

The average value of cows of the better herds was practically the same at the end of the year as at the beginning. This would perhaps lead to the conclusion that there had been no depreciation, which was apparently the case in the Sheboygan County herds. In the other groups, however, the young cows did not increase in value to the same extent, the cows sold did not bring so near their inventory valuations, and the valuations at the end of the year were much smaller than at the beginning of the year. In figuring the depreciation, the young cows added to the herd were appraised at 75 per cent of the average value of the cows in the herd at the beginning of the year. The charge to the herd on account of heifers is made in order to separate the milk production enterprise from the cost and returns on account of young stock. The average value of the young cows so added was $339 per farm, or $125 per head, which approximates the cost of raising a 2-year-old heifer of the quality of the average cows in the herds.

The death risk is rather small, in this case a little more than 2 per cent. There is a further appreciable loss, but variable, due to accidents and culling, where the loss is partial, as in the case of cows sold to the butcher or to other dairymen. Even when condemned for

tuberculosis the cows are not a total loss. Cows culled from the best herds may be attractive purchases for herds of lower standards of production, and the shrinkage in value may thus be distributed over a number of farms, but ultimately the cow will find her way to the butcher or will die on some farmer's hands. Breeders probably suffer less from depreciation than farmers who buy their stock, because they have young stock increasing in value.

Normal depreciation has not been of sufficient importance to attract strict analytical study. As an indication of the scope of the problem, it may be remarked that besides the 18 per cent here estimated under conditions acknowledged to be unusual, a rate of depreciation of 26 per cent in one year has been observed in one herd of over 300 cows, where the rearing of young stock was not a part of the farm business and so did not obscure the figures, and of about 11 per cent in another herd of 40 cows where all the factors involved were kept strictly separated. In each of these latter cases, the cows were forced and used up much faster than dairy farmers usually find economical. In times of rising prices there may be an increase in the value of cows more than enough to offset physical depreciation.

On the whole, from the year-after-year viewpoint, it would seem fair to allow a minimum of 6 per cent for depreciation instead of the 18 per cent claimed for 1920, and 6 per cent interest, both based on the valuation at the first inventory. At this rate there would be a charge of $19.80 per head, or 27 cents per 100 pounds of milk for these cows. If the full depreciation claimed by these farmers were allowed, the cow cost would be 62 cents per 100 pounds, of which 14 cents is for interest.

BULL SERVICE.

Bulls vary widely as to their value and the size of the herd they head. So far as milk production alone is concerned, bull service as a cost is just short of negligible. Except for his influence on the young stock, one bull will do as well as another, and the prevalence of grade and scrub bulls throughout the State indicates that many farmers fail to appreciate the bull's influence on the value of the stock. Frequently bulls are kept on farms for convenience only, and, except for convenience (occasionally contagious abortion in a neighborhood may be the deciding factor), keeping a bull is not warranted on a large number of farms. By cooperative ownership some farmers have been able to secure all the advantages of the use of a high-class pure-bred bull in improving their young stock. Occasionally a farmer with a small herd is obliged to maintain a bull because of inability to secure service locally at a reasonable fee.

Bull service does not count as an offset to cost of keep on the farms under discussion. Under ordinary circumstances in Wisconsin the difference between the cash received for veal calves and the current market value of the milk fed to them is sufficient to meet the cost of keeping an ordinary grade bull, especially in view of a general tendency to include the bull's feed and care with the feed and care of cows in farm calculations. Any costs incident to higher valuations are properly assigned to the cost of the offspring and do not therefore affect the cost of milk.

BUILDING COST (RENT).

This item varies from farm to farm (see Table 1), and close examination reveals no direct relation between it and the cost of 100 pounds of milk. The better herds are usually kept in the more pretentious barns. Many an old barn, however, shelters a first-class herd, and many an otherwise profitable herd is rendered unprofitable by excessive investment in buildings and equipment. The building cost per cow is lowest when the barn is full and production is high; for a given farm it is the same regardless of the number of cows kept or of their rate of production. Suppose a barn with fixed equipment is worth $4,000 in its present condition and will house 15 cows. This would indicate a rent of $300 a year at 7½ per cent of valuation, at the lowest calculation. If the barn were full of 10,000-pound cows the cost per 100 pounds would be 20 cents, while if they were 7,000-pound cows the cost would be 28.5 cents; a reduction from 15 to 10 cows of the higher grade would raise the cost to 30 cents per 10 pounds while reducing to ten 7,000-pound cows would make it nearly 43 cents.

Since barns are commonly built to provide for the cattle, horses, crop storage, and frequently for hogs and machinery as well, it is more bother than most farmers are willing to take to apportion the cost of the buildings to the different purposes served, to say nothing of a general hesitation about assigning a value which is largely an estimate, or observing the actual cost over any extended period of time.

Assuming $2,500 as an average estimated valuation of the share of the buildings devoted to the cows and storage of the necessary feed, and 7½ per cent as a minimum allowance, the rent is $187.50, or 20 cents per 100 pounds of milk for the average herd.

EQUIPMENT.

The equipment used in milk production, beyond the items usually considered as a part of the barn, is limited in amount. It includes pails, cans, strainers, scales, feed carts, a few cream separators, and an occasional milking machine. The investment in equipment, excepting the milking machines, averages about $50, on the farms studied, and entails an annual expense of about $12 replacements, which, together with the interest, warrants an allowance of 1½ cents per 100 pounds of milk.

GENERAL EXPENSE.

The reports on this item were not complete in all respects, but judging from those which were complete, an allowance of 5½ cents per 100 pounds, or about $50 per farm for the year would be necessary to meet general expenses not provided for otherwise.

PRODUCTION AND PRICES.

Cows naturally produce more milk in summer than in winter, but milk and dairy products are wanted all through the year in about the same quantities. This creates the deficit and surplus problem, so vexing to manufacturers and distributors, and is reflected in the prices paid. Winter milk is at a premium, and summer milk returns a price determined by the quantity offered and the specu-

lator's judgment regarding the probable price of the stored products later in the year.

The distribution of the production of the 48 farms reporting is shown in Figure 3. Over half the milk was produced in five months, March to July, inclusive. August, September, and October were the months of lowest production. Pasture stimulates the milk flow of cows freshening in the early winter, and there is further increase in the spring owing to the large numbers of cows freshening at that time. One reason for the spring freshening is to avoid the necessity for the heavier feeding required to sustain the milk flow in winter. August is a trying month for cows, chiefly on account of failing pastures, and once they are allowed to fall off in yield they can not often economically be brought back in the fall. Grass pasture, so far as milk cows are concerned, is about exhausted by the

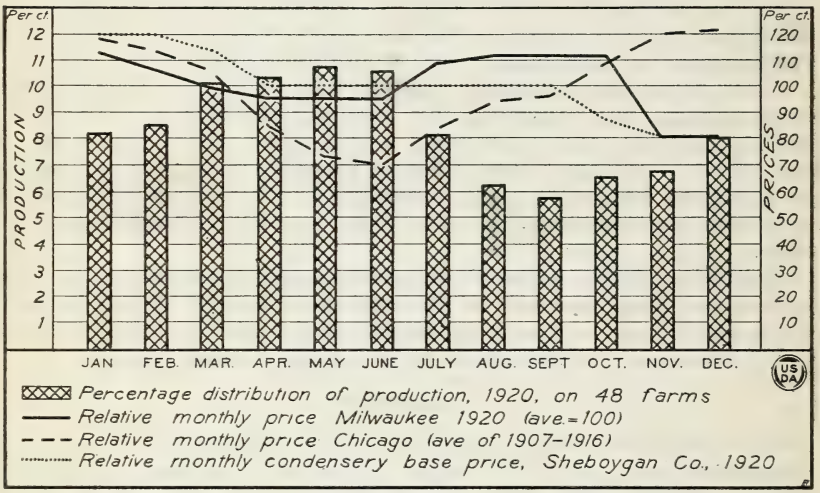

FIG. 3.—Spring was the season of maximum production on these farms in 1920. Failure of milk prices to follow the normal course in the autumn was marked and had a depressing influence on production.

middle of July, and supplementary feed is necessary unless fresh pasture is available, or the aftermath of the fields[5] is sufficient. Grain feeding was not resumed as promptly in 1920 as usual on account of the high price of feed and discouraging outlook for milk prices.

The average price of milk for 1920 for the Sheboygan County group was $2.33 per 100 pounds, the range being from $1.81 to $3.13; for the Marathon County group from $2.11 to $2.94, average $2.67; for the Columbia County group $2.30, with a range from $2.12 to $2.46, while the Milwaukee producers averaged $3.15 net at the farm. The range in price in any locality is caused not so much by difference in schedule prices paid by the factories as by the distribution of the production and the butter-fat test of the milk.

As between the Milwaukee price and prices outside Milwaukee, the higher price paid is due in no small measure to the activities of the

[5] Aftermath is secured from grain and crop fields as well as from hay fields.

Milwaukee Milk Producers' Association, which looks after the interests of its members, bargaining with the distributors with respect to price and taking care of all the surplus. Milk is sold at a uniform price per can (of 8 gallons) delivered in Milwaukee. All producers get the same price except for the cost of hauling to the city. Two cents per 100 pounds is paid into the association fund by each member to help meet unavoidable manufacturing losses. Market milk usually commands a higher price than factory milk, because of additional requirements and because no by-products are returned. Condensaries also pay somewhat higher prices than cheese factories for the latter reason. Outside the Milwaukee area practically all the milk is sold by test. Producers of high-test milk in the Milwaukee area usually plan to sell cream or have a special trade.

Price quotations commonly available need considerable interpretation because of differences in practice. Condensaries usually quote a base price per 100 pounds of 4 per cent milk. Creameries and cheese factories pay for butter fat according to test, and quote prices as so many cents per pound of butter fat. Thus, comparisons with whole milk are made by a simple multiplication, usually neglecting the skim milk or whey value. However, unless the milk tests 4 per cent the farmer does not get the quoted price. Comparatively few get the quoted price, for if cows are milking heavily, especially if they are Holsteins, the test is likely to be less than 3.5 per cent. Some factories pay a straight rate per pound of fat as shown by the test, others deduct from or add to the base price a fixed number of cents per pound for every tenth of 1 per cent by which the milk tests less or more than 4 per cent. This may have the effect of penalizing the farmer with low-test milk. Many condensaries maintain collecting routes and charge for hauling, saving the farmers the cost of making daily trips. These are perfectly straightforward and open practices, but they mean that many farmers do not and can not get for their milk the prices that quotations would indicate.

The differences between quoted prices and what a farmer gets for his milk are likely to be still more marked when several months are averaged. The common average of monthly quotations reflects the true average, in which alone the farmer is interested, only when the sales of milk are the same for each month. To illustrate: A common average price of $3.624 was quoted in 1919 by a condensary. One of its patrons, using his actual monthly prices in the common way, found his average was $3.31, with a range from $2.55 to $4.05. But even with good Guernsey cows he did not get the base price for more than 6 per cent of his milk; 65 per cent was sold in five months at $2.55 to $2.91 while the quoted price ran from $3.29 to $3.40 in these same months. His true average price for the year, before deducting hauling, was $3.09, netting $233 less on his total sales than his "average" price led him to suppose.

Other practices have been noted, all aiming to avoid unfavorable discussions among patrons about prices. In short, each producer must know definitely what he gets for his milk and why he does not get more.

The normal price movement by months is also shown in Figure 3 as the relative monthly prices 1907–1916 in Chicago. The highest

prices are usually paid in December and January; lowest prices in May, June, and July. The 1920 prices did not follow the normal course. Instead of going up in the fall they went down. The high prices in late summer are partly explained by the success of producers in bargaining, with high cost as the basic argument, which distributors considered, but following the fall in grain prices, milk prices could not be sustained.

The spread in prices is some inducement to winter production, and those who produce in winter receive higher average prices for their milk than those who follow the normal practice. But the spread in prices is not commonly held to be sufficient to offset the extra cost of feeding for winter milk production, above roughing the cows through the winter and turning them out all summer where pasture is abundant. The chief arguments, however, for winter production are that the total yield for the year is increased by having the cows freshen in the fall, and that there is a better distribution of the farm labor over the year. Many who follow this practice say "it is easier to produce milk in the winter." There is more time to care for the cows, feeding can be controlled more definitely, there is not so much milking to do in hot weather and harvest time, and the production of cows suffers less from heat, flies and shrinking pastures. With the higher producing cows, year-around feeding is necessary, so that the time of freshening is not a significant factor in feed consumption. There may be some increase in "opportunity cost of feed," by which is meant that the farm price of feeds increases from harvest time on, and feeds might have been sold at increased prices instead of being fed, but the necessary supplies are definitely set aside on a dairy farm for the stock and the question of possible sale is disposed of early in the season. Purchased feed is also provided for on the same basis. The record of 120 cows in the Register of Production,[6] selected without regard to any factor other than date of freshening, were examined to determine the effect of time of freshening on production and on feed supply. The records of the cows freshening in each month of the year were taken. There was no significant difference in the average production, and very little difference in the character of the feed consumed. The fall-fresh cows were fed a little more grain than the cows freshening later in the winter, but the April and June fresh cows consumed more than the average. Of the 421 cows listed, only 142 freshened between March 1 and September 1.

Storage of butter, cheese, condensed milk, milk powder, and ice cream materials, tends to keep the winter price of milk below and the summer price above the points they would naturally reach without storage facilities. This is of benefit both to the consumer, who can have as much as he desires at all times, and to the producer, who, on account of the tendency of production to concentrate in the low price months, gets a higher price for his year's product.

Though the cost of milk is higher in winter than in summer, it is more nearly uniform than prevalent methods of figuring indicate. The tendency to figure cost of feeding dry and nearly-dry cows as part of the cost of winter milk is practically unavoidable. It results in a cost figure, which would mean a prohibitive price of dairy

[6] Wisconsin Agricultural Experiment Station Circular 129.

products or would spell loss to producers at winter prices of feed and usual prices paid for milk. It does not lay enough emphasis on the value of pasture as feed, and reconciles the producer to an unduly low price of milk in summer. "Pasture is cheap feed," farmers say; no grain is needed and less work is required; so low prices in summer are accepted with a shrug of the shoulders. Yet the cost of carrying cows through the winter is part of the cost of producing milk on pasture. Thus, though winter prices do not go so high as cost figures would indicate, summer prices do not go so low. A more nearly uniform price throughout the year, as urged at times, would tend to increase the concentration of production in the summer and would defeat its purpose. Only in the market-milk zone can anything approaching uniform price be effective, and then only when distributors are relieved of the burden of surplus milk, and on condition that milk from outside the normal territory for the city supply be kept off the city market, conditions which practically can not be met in the present state of organization of producers and of their control over production.

Adjustment of prices in favor of producers is a slow matter, requires continuous effort, and has not yet been wholly satisfactory with respect to price. Pooling plans have met with some measure of success in times of rising prices, but their story is not yet fully told; some of them have recently caused financial loss to participants. Still this kind of effort warrants the support of every producer. The individual producer must look to his own devices for improving his situation with regard to current costs and prices. Each needs to analyze his own results to determine current relations between his costs and prices, and proceed to make the adjustments necessary. These adjustments will usually be in the direction of adequate feeding, prompt and thorough culling, constructive breeding, and keeping expenses as low as possible.

In the matter of individual items of expense, one must bear in mind that low expense does not necessarily mean low cost if thereby production is restricted. Most dairy farms are provided with silos, although occasionally a farmer is found who does not yet believe in the silo. Most of these who do not have silos will have them when they can spare the funds necessary to build them. Silos are investments rather than expenses, and pay good returns. Silage as feed is itself relatively cheap and makes other feeds more effective. Drinking cups call for a considerable outlay, but the effect on production is so marked that more than one farmer has said that he would not be without them if he had to install a new set each year. In one case observed, a barn housing only six cows was provided with cups.

The matter of justifying the remodeling of stables to provide more light and air, concrete floors, swinging stanchions, which add to the health and comfort of the cows, is more difficult, as is also the question of outlay for litter carrier, feed cart, chutes for hay, and other labor-saving devices, the return from which is distributed over a long time and is indirect. It is impossible to relate losses from tuberculosis directly to poor accommodations for cows, but there is small room for doubt that a relation between the two exists. Many a farmer suffers a daily drain because of poor arrangement of his

buildings and equipment, caused by the gradual development of his business and often not to be altered without rebuilding, but a tax none the less on his effort. As pointed out the judicious additional expenditure for high protein feeds to balance the ration, and for any kind of feed to maintain production as pastures fail has an effect on the year's return greatly in excess of its relation to the immediate cost. There is also the further means of reducing costs by careful scrutiny of the relative values of the feeds available, buying those which provide digestible nutrients at the lowest figures. In this way the dairyman produces at the lowest possible feed cost, and guards against paying excessive prices.

The constant examination of conditions is not a guaranty against loss, but is effective insurance against ordinary failure to make ends meet.

SUMMARY OF COSTS.

From this discussion it appears that the cost of producing milk in 1920 on the 48 farms in question was $3.30 per 100 pounds, with a modified allowance for depreciation, or $3.57 per 100 pounds with depreciation as observed. This figure includes an allowance of 19 cents per 100 pounds for interest, which some authorities maintain should not be displayed as an element of cost, though they agree that the price of the product must ordinarily be sufficient to cover it.

TABLE 5.—*Average cost of producing milk on 48 Wisconsin farms, 1920.*

Item.		Average cost per 100 pounds.	Per cent of net total cost.
Feed		$2.02	.....
Allowance for manure		.29	.....
Net cost of feed		1.73	53
Labor		.94	28
Hauling		.09	3
Other costs:			
Cow cost	$0.27		
Building use	.20		
Equipment use	.015		
General expenses	.055		
		.54	16
Net total cost		3.30	100
Deducting interest		.19	
Cost not including interest		3.11	
Average price of milk		2.65	
Opportunity loss		[1] 0.65	

[1] Or $0.46 without interest.

To offset a part of this loss some of the farmers took whey back from the factory for hog feeding, while others had skim milk for calf feeding. No fair estimate of the amount of this offset was obtained. Its value to a farmer depends on the use to which he puts it, and while it might be argued that farmers should use all the by-product in reduction of cost of the main product, cheese factory patrons do not always care to feed as large a number of hogs as the whey from their milk will feed, nor is it always possible to do so without changing their farm plans. Those who skim at the farm can make good use of the skim milk for calf feeding, and often have some left over

for hogs. Of the 48 farmers reporting, 27 sold whole milk, 12 sold to cheese factories and 9 sold cream.

The computed cost of 100 pounds of milk and the value of the milk produced on the farms studied is shown in Table 6. The value of the milk fed to calves and of that used by the farm family varies materially. Neither value is generally considered of much significance. The quantity sold is usually the figure used by farmers when they think of quantities at all, except for records of individual cows. In this study the quantities sold, fed to calves, and used by the farm family were reported separately each month. The proportion of the total quantity produced used on the farm varied from about 1½ to 15 per cent. In the months of lowest production, in a few cases practically all of the milk was used on the farm.

TABLE 6.—*Cost of 100 pounds of milk and average value of milk produced on 48 Wisconsin dairy farms in 1920.*

	Group A.	Group B.	Group C.	Group D.	Group E.	All farms.
Number of farms	12	8	11	8	9	48
Average production per cow, pounds	9,820	6,940	6,700	6,290	5,570	7,320
VALUE OF MILK PRODUCED, 1920.						
Cash sales, per farm	$2,691.00	$2,690.00	$2,713.00	$1,742.00	$1,343.00	$2,281.00
Calf milk	233.00	305.00	222.00	112.00	70.00	194.00
Family supply	73.00	73.00	64.00	39.00	99.00	71.00
Total, at market price	2,997.00	3,068.00	2,999.00	1,893.00	1,512.00	2,546.00
Average price per 100 pounds	2.33	2.38	3.15	3.15	2.67	2.65
COMPUTED COST OF 100 POUNDS OF MILK, 1920.						
Feed	$1.80	$2.07	$2.19	$2.32	$1.82	[1] $2.02
Manure—credit	.24	.32	.32	.34	.28	.29
Net cost of feed	1.56	1.75	1.87	1.98	1.54	[1] 1.73
Labor at 40 cents per hour	.68	.84	1.00	1.39	1.21	.94
Hauling milk sold	.08	.14	.07	.02	.18	.09
Cow cost	$0.24	$0.31	$0.30	$0.18	$0.24	$0.27
Building use	.12 .41	.20 .56	.28 .65	.25 .54	.18 .53	.20 .54
Equipment and general	.05	.05	.07	.11	.11	.07
Total cost	2.73	3.29	3.59	3.93	3.46	3.30
Claimed depreciation	.02	1.00	.45	.52	.29	.48

[1] This is 8 cents per 100 pounds larger than a strict weighted average. For prices used in computations see page 7.

OTHER CONSIDERATIONS.

In separating one enterprise for particular study from a number of closely related, interdependent enterprises it is necessary to make some more or less arbitrary divisions of costs and benefits, to which many may take exception. There is opportunity for argument on every item of milk cost, especially in the feed and labor items. Competition is the ruling factor, with farmers bidding against each other and consumers paying as little as they are obliged to pay. It is not so much a question of what milk costs as of what farmers are willing to take for their milk. Just as a long period of rising prices was necessary to attract enough milk to glut the market in the fall of 1920, so a period of low prices will be necessary to discourage the less-

favorably situated dairymen to the point of giving up milk production, and they seem likely to persist, partly because milk production seems to pay better than other alternatives and partly because they are willing to take less for their milk and therefore less for their services than others. This is what makes it so hard for dairymen to agree on a price and to hold together when a price is set. No price can be established on "cost of production," for, once a price is made, costs are immediately altered either by increasing production or decreasing or increasing costs of materials, or, more than likely, a combination of these alternatives. During the process of adjustment some dairymen are bound to suffer loss.

Some farmers concerned in this study were able to produce milk at a cost less than the price received by virtue of unusually high production or of unusually low expenses, or of a combination of the two, resulting in low unit costs. Most of them also had other enterprises which contributed to the annual income. Farm income exceeded farm outlay, but out of that margin had to come the living of the family and the maintenance of the farm buildings, equipment, live stock, and supplies. Many dairymen had to draw on these supplementary sources of income in 1920 to make up for deficits in the main line.

The supplementary sources of income are different in the different areas. The farmers in the Sheboygan County group sold crops, hogs, and poultry products in about equal amounts. The Columbia County group sold peas for canning, and hogs. The Milwaukee district groups sold truck crops and potatoes. The Ozaukee County group sold potatoes, sugar beets, and poultry. The Marathon County group sold some crops, hogs, and logs. A few farms reported no income except from the dairy enterprise. The receipts from crops varied from nothing up to about $4,000, hogs up to $1,400, poultry and eggs up to $975. The average increase in cattle other than cows was $493. The expenses incurred in producing these items were not separated. With the exception of the cattle, these supplementary sources of income do not warrant figuring an average, as an average would give only a vague and distorted idea of them. The crop inventory at the end of the year was in most cases larger in quantity than on January 1, but smaller in value, the price shrinkage amounting to several hundred dollars on many farms if compared with the crop value figured at prices in effect January 1, 1920.

The larger farms offered greater opportunity for employing the labor available, had larger incomes and larger expenses. As far as milk production is concerned, there does not seem to be any correlation between size of farm and cost of milk. Recession of inventory values absorbed a large part of such income as might be figured.

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